

(19)



Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number:

0 103 752
A2

(12)

EUROPEAN PATENT APPLICATION

(21) Application number: 83108145.0

(22) Date of filing: 17.08.83

(51) Int. Cl.³: C 07 C 127/24
C 07 C 125/077, C 07 D 303/16
C 07 D 203/20, C 07 D 251/32
D 06 M 13/40

(30) Priority: 20.08.82 JP 143483/82

(43) Date of publication of application:
28.03.84 Bulletin 84/13(54) Designated Contracting States:
DE FR GB(71) Applicant: ASAHI GLASS COMPANY LTD.
No. 1-2, Marunouchi 2-chome
Chiyoda-ku, Tokyo(JP)(72) Inventor: Matsuo, Masashi
Ohkurayamayohkohaitsu 418 No. 39, Ohkumacho
Mikori-ku Yokohama-shi Kanagawa-ken(JP)(72) Inventor: Itoh, Katsuji
2-59-1, Tsurugamine Asahi-ku
Yokohama-shi Kanagawa-ken(JP)(72) Inventor: Hayashi, Takao
7-13-29, Zushi
Zushi-shi Kanagawa-ken(JP)(72) Inventor: Oda, Yoshio
No. 435, Kamisugetacho Hodogaya-ku
Yokohama-shi Kanagawa-ken(JP)(74) Representative: Wächtershäuser, Günter, Dr.
Tal 29
D-8000 München 2(DE)

(54) Stain-proofing agent containing a polyfluoroalkyl group, and process for its preparation.

(57) A stainproofing agent containing as an active ingredient,
a polyfluoroalkyl group-containing compound represented
by the following general formula and having a molecular
weight of from 800 to 3000:



where R₁ is a polyfluoroalkyl group having from 1 to 20
carbon atoms, X is -R-, -CON(R¹)-Q- or -SO₂N(R¹)-Q- (where R
is a divalent alkylene group, R¹ is a hydrogen atom or a lower
alkyl group and Q is a divalent organic group), each of A and
A' is -O-, -S- or -N(Z')- (where Z' is a hydrogen atom or a
monovalent organic group), Z is a monovalent organic
group, W is a trivalent organic group, a is an integer of 1, 2 or
3. A process for the stainproofing agent is also disclosed.

EP 0 103 752 A2

Croydon Printing Company Ltd

BEST AVAILABLE COPY

see from page

- 1 -

STAINPROOFING AGENT AND PROCESS FOR ITS PREPARATION

The present invention relates to a novel stainproofing agent containing a certain specific polyfluoroalkyl group-containing compound as an active ingredient and a process for its preparation.

5 Heretofore, in the treatment of fiber products such as woven fabrics or carpets with a treating agent having a polyfluoroalkyl group (hereinafter referred to as a "PFA group"), it has been common to employ a method wherein the treating agent is coated on the surface of the fiber product by means of an aqueous emulsion or organic
10 solvent solution of an acrylate-type high molecular weight polymer. However, such a high molecular weight treating agent constitutes a non-continuous phase held on the fiber surface mainly by physical adhesive power, and consequently tends to be abraded off when the fibers are subjected to mechanical actions during the processing to
15 a final product or during the use as the fiber product. Further, the high molecular weight treating agent having a PFA group has a deficiency in its effectiveness to impart a stainproofing property such as an anti-dry soil property which is important particularly for the treatment of carpets.

20 On the other hand, there have been proposed various means to overcome the above-mentioned deficiency of the high molecular

weight treating agent. For instance, it has been proposed to use as a treating agent a low molecular weight fluorinated compound composed of a derivative of e.g. phthalic acid, terephthalic acid, trimellitic acid or pyromellitic acid. (See U.S. Patents No. 3,646,153, No. 3,870,748 and No. 4,209,610.) Further, as a material useful as a stainproofing agent for e.g. carpets, various fluorine-containing urethane compounds having PFA groups have been proposed, for instance, in U.S. Patent No. 3,398,182 and Japanese Unexamined Patent Publications No. 112,855/1978 and No. 74,000/1979.

10 The present inventors have now found that a relatively low molecular weight compound obtained by reacting e.g. a PFA group-containing alcohol to a trifunctional isocyanate compound, effectively overcomes the deficiencies of the above-mentioned high molecular weight treating agent and is superior in its abrasion durability to a low molecular weight fluorinated compound such as the conventional fluorine-containing urethane compound. Such a specific compound has a molecular weight of from 800 to 3000 and contains at least three urethane bonds or urea bonds as well as at least one PFA group. Such a PFA group-containing specific compound may be used prior to the dyeing step and is also advantageously be used as a treating agent at the time of spinning base yarns for fiber products such as carpets. Namely, the specific treating agent of the present invention is capable of providing a stainproofing property when used at the time of spinning and will not fall off from the fiber products even during the dyeing step and does not adversely affect the dyeing.

25 Thus, the present invention provides a stainproofing agent containing as an active ingredient a polyfluoroalkyl group-containing compound represented by the following general formula and having a

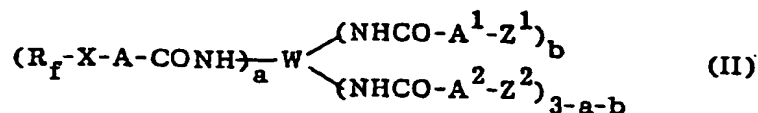
molecular weight of from 800 to 300:



where R_f is a polyfluoroalkyl group having from 1 to 20 carbon atoms,
 5 X is $-R-$, $-CON(R^1)-Q-$ or $-SO_2N(R^1)-Q-$ (where R is a divalent
 alkylene group, R^1 is a hydrogen atom or a lower alkyl group and Q is
 a divalent organic group), each of A and A' is $-O-$, $-S-$ or $-N(Z')-$
 (where Z' is a hydrogen atom or a monovalent organic group), Z is a
 monovalent organic group, W is a trivalent organic group, a is an integer
 10 of 1, 2 or 3.

From a further study, it has also been found that a stainproofing
 agent having particularly good water repellency can be obtained by
 reacting a trifunctional isocyanate compound with a combination of
 a PFA group-containing alcohol and $n-C_{18}H_{37}OH$, $n-C_{18}H_{37}NH_2$ or
 15 $n-C_{18}H_{37}SH$. Namely, a relatively low molecular weight compound
 thus obtained which contains at least one PFA group and at least
 one straight chain stearyl group (hereinafter sometimes referred to
 as " $C_{18}H_{37}$ ") and which further contains at least three urethane bonds,
 urea bonds or thiourethane bonds, is capable of imparting especially
 20 good water and oil repellency and stainproofing property and it also
 provides a superior abrasion durability.

Thus, present invention provides a preferred stainproofing agent
 which contains as an active ingredient a polyfluoroalkyl group-containing
 compound represented by the general formula:



where R_f , X, A and W are as defined above, each of A^1 and A^2 is -O-, -S- or -N(Z')- (where Z' is as defined above), Z^1 is a straight chain stearyl group, Z^2 is a monovalent organic group, a is an integer of 1 or 2 and b is an integer of 1 or 2.

According to the study of the present inventors, when a diisocyanate (OCN-Y-NCO) is reacted with water, a dimer of OCN-Y-NHCONH-Y-NCO is formed. When reacted with a monomer of OCN-Y-NCO, such a dimer forms a trimer of OCN-Y-N-CONH-Y-NCO.

Further, when two such dimers are reacted with each other, a tetramer of $\text{OCN-Y-N-CONH-Y-NCO}$ is formed. Likewise, $\text{CONH-Y-NHCONH-Y-NCO}$

when the dimer and the trimer are reacted, a pentamer is formed.

15 In a similar fashion, various polymers will be formed. By such an addition reaction of a $>\text{N-H}$ group with a $-\text{NCO}$ group, a mixture of polyfunctional isocyanate compounds having at least three $-\text{NCO}$ groups is obtainable. For instance, the above-mentioned trimer or tetramer has three $-\text{NCO}$ groups, and the tetramer obtained by the reaction of
20 the monomer with the trimer or the pentamer obtained by the reaction of the dimer with the trimer, has four $-\text{NCO}$ groups.

The present inventors have found that when e.g. a PFA group-containing alcohol is reacted to the mixture of polyfunctional isocyanate compounds having at least three -NCO groups, it is possible to obtain a mixture of relatively low molecular weight PFA-containing compounds, and the mixture thereby obtained effectively overcomes the above-mentioned deficiency of the high molecular weight treating agent and

is superior in the abrasion durability to a low molecular weight fluorinated compound such as the conventional fluorine-containing urethane compounds. The specific compounds contained in the mixture have a molecular weight of at most 8000 and contain

5 at least three -NHCO-groups and at least one PFA group. Namely, at least one of -NCO groups in the polyfunctional isocyanate compound is converted to a group containing a PFA group, and the rest of the -NCO groups are converted to PFA group-containing groups or other organic groups.

10 The mixture of the PFA group-containing compounds thus obtained is useful as a treating agent at the time of spinning base yarns for fiber materials such as carpets. Namely, the mixture is capable of imparting a stainproofing property when used at the time of spinning, and will not fall off from the fiber products during

15 the dyeing step and does not adversely affect the dyeing.

Thus, the present invention also provides a process for preparing a stain proofing agent, which comprises reacting a mixture of polyfunctional isocyanate compounds having at least three -NCO groups and a -NHCON bond derived from an addition reaction of a >N-H

20 group-containing compound with a -NCO group-containing compound, with a compound represented by the general formula $R_f-X-A-H$ where R_f is a polyfluoroalkyl group having from 1 to 20 carbon atoms, X is -R-, $-CON(R^1)-Q-$ or $-SO_2N(R^1)-Q-$ (where R is a divalent alkylene group, R^1 is a hydrogen atom or a lower alkyl group

25 and Q is a divalent organic group) and A is -O-, -S- or -N(Z')- (where Z' is a hydrogen atom or a monovalent organic group), and,

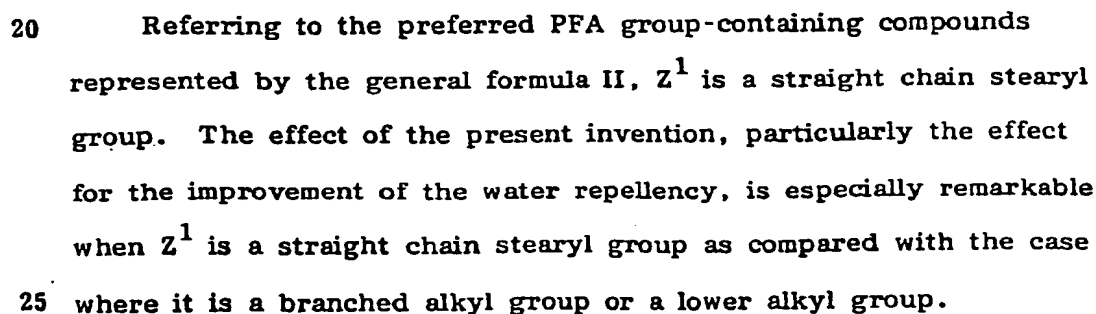
if required, further reacting the mixture with a compound represented by the general formula $Z-A'-H$ where Z is a monovalent organic group and A' is $-O-$, $-S-$ or $-N(Z)-$ (where Z' is a hydrogen atom or a monovalent organic group), to form a mixture of polyfluoroalkyl group-containing compounds having at least one $-NHCO-A-X-R_f$ group where
 5 A , X and R_f are as defined above, a molecular weight of at most 8000 and, if required, at least one $-NHCO-A'-Z$ group where A' and Z are as defined above, provided that the total of the $-NHCO-A-X-R_f$ groups and the $-NHCO-A'-Z$ groups is at least three.

10 Now, the present invention will be described in detail with reference to the preferred embodiments.

In the above general formulas, R_f is a straight chain or branched polyfluoroalkyl group having from 1 to 20 carbon atoms, preferably from 4 to 16 carbon atoms. It is usual to choose a compound having
 15 a perfluoroalkyl group at its terminal. However, the terminal group may not necessarily be a perfluoroalkyl group and may be a hydrogen atom, a chlorine atom or an oxyperfluoroalkylene-containing group. R_f is preferably a perfluoroalkyl group represented by the general formula $-C_nF_{2n+1}$ where n is an integer of 4 to 16, more preferably
 20 from 6 to 12.

X is $-R-$, $-CON(R^1)-Q-$ or $-SO_2N(R^1)-Q-$ (where R is a divalent alkylene group, R^1 is a hydrogen atom or a lower alkyl group and Q is a divalent organic group). X is preferably a divalent alkylene group having from 1 to 10 carbon atoms, preferably from 2 to 4 carbon
 25 atoms, represented by the general formula $-C_mH_{2m}-$ (where m is an integer of 1 to 10, preferably 2 to 4). Q is a divalent organic group, and is preferably a divalent alkylene group of the formula $-R-$.

Z is a monovalent organic group and may be the same as the above-mentioned Z', or Z may together with Z' form a ring. Likewise, referring to the general formula II, Z² is a monovalent organic group and may be the same as Z', or it may together with Z' form a ring. For instance, each of -A'-Z and -A²-Z² is preferably -OR' (where R' is an alkyl group), -NHCH₂OH, -NHCH₂CH₂OH, -NHCH₂CH₂OCH₂CH₂CH₂OH,



In the PFA group-containing compounds of the general formula I, W is a trivalent organic group, and a is an integer of 1 to 3. Such PFA group-containing compounds should have a molecular weight of from 800 to 3000, preferably from 1000 to 2000. If the molecular weight is too high, the durability of the stainproofing effect tends to be poor, and there will be certain difficulties in their use prior to the dyeing step or during the spinning of the base yarns. The derivatives obtained from trifunctional isocyanate compounds according to the present invention are superior in the above-mentioned durability to the derivatives obtained from difunctional isocyanate compounds such as relatively low molecular weight fluorine-containing urethane compounds.

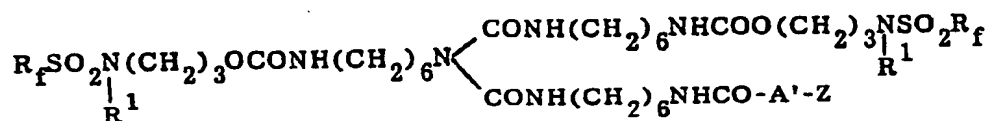
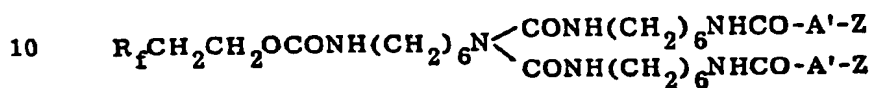
In the present invention, the PFA group-containing compounds include those wherein a is 3. However, with a view to a further improvement of the durability by adequate adhesion of the compound to the surface of synthetic fibers, a is preferably 1 or 2 and the compound contains at least one -NHCO-A'-Z group. Usually, the PFA group-containing compounds of the general formula I are prepared by reacting a fluorine-containing compound of $R_f-X-A-H$ and a compound of $Z-A'-H$ to a trifunctional isocyanate compound of



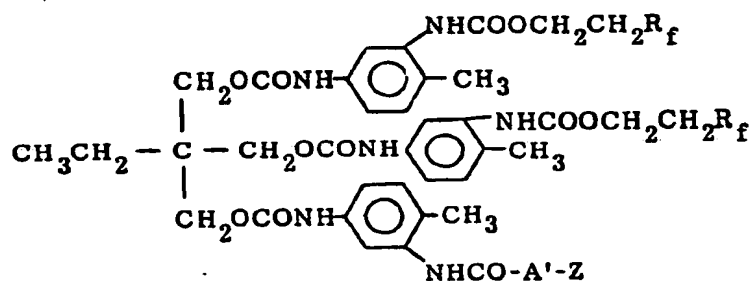
the general formula II, a is an integer of 1 or 2 and b is an integer of 1 or 2. The preferred PFA group-containing compounds include those wherein a+b is 3. However, with a view to a further improvement of the durability by adequate adhesion of the compound on the surface of the synthetic fibers, a+b is preferably 2, and the compound preferably contains at least one $-NHCO-A'^2-Z^2$. The preferred PFA

group-containing compounds of the general formula II are usually prepared by reacting a fluorine-containing compound of $R_f-X-A-H$, a stearyl group-containing compound of $C_{18}H_{37}-A^1-H$ and a compound of Z^2-A^2-H to a trifunctional isocyanate compound of $\left(W \begin{matrix} \nearrow NCO \\ \searrow NCO \\ \searrow NCO \end{matrix} \right)^*$.

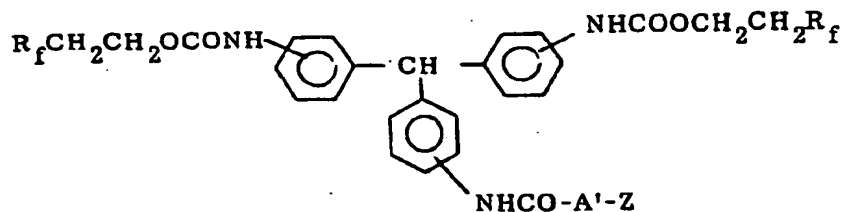
- 5 Specific examples of the PFA group-containing compound of the general formula I will be given below.

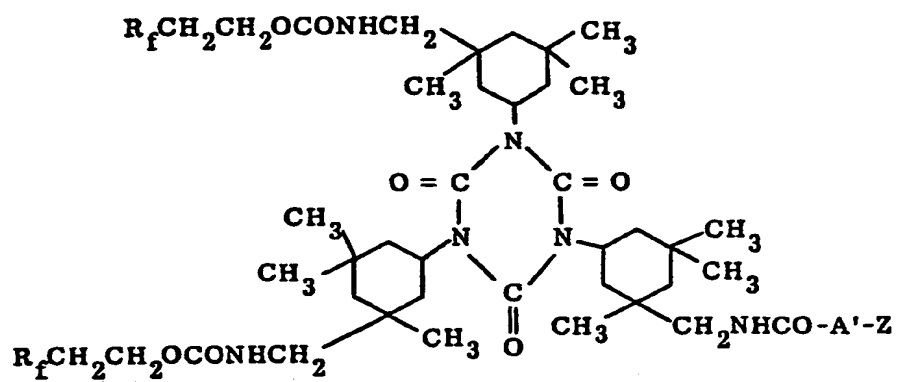
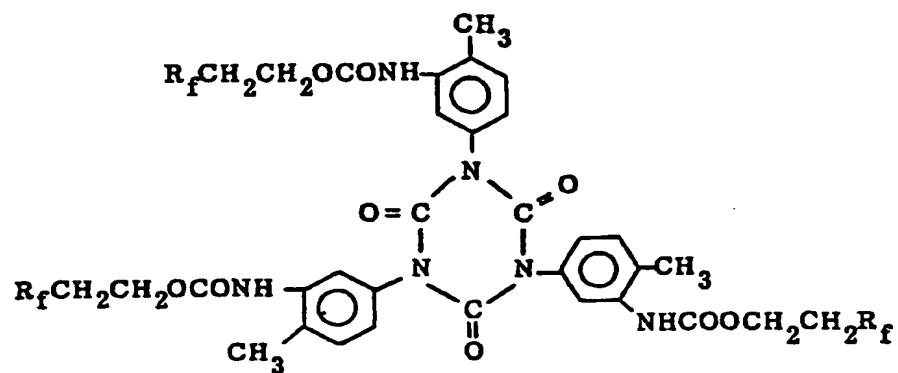


15

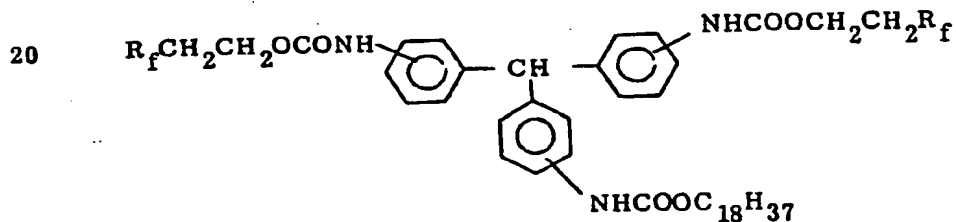
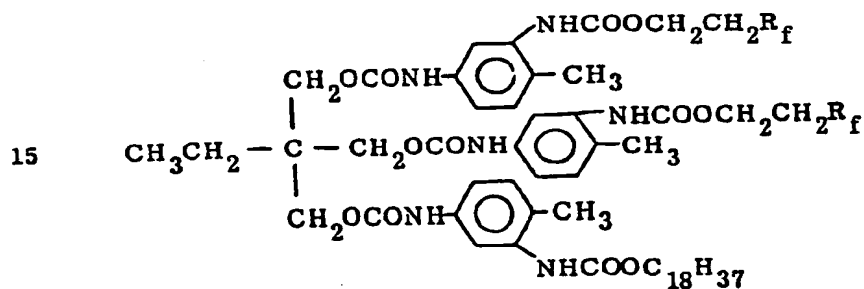
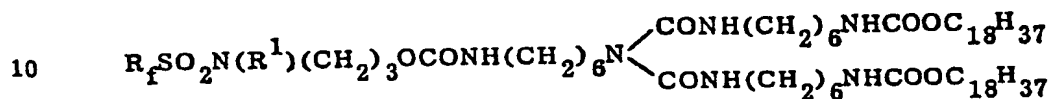
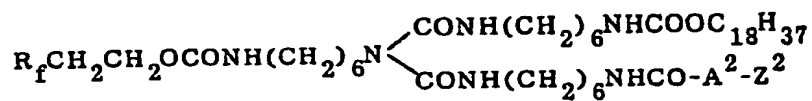
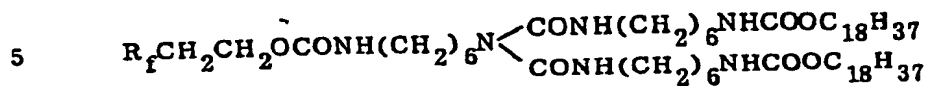
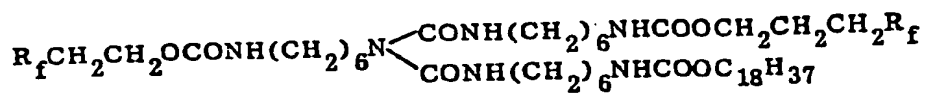


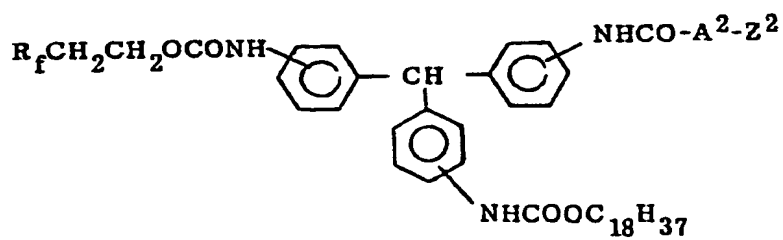
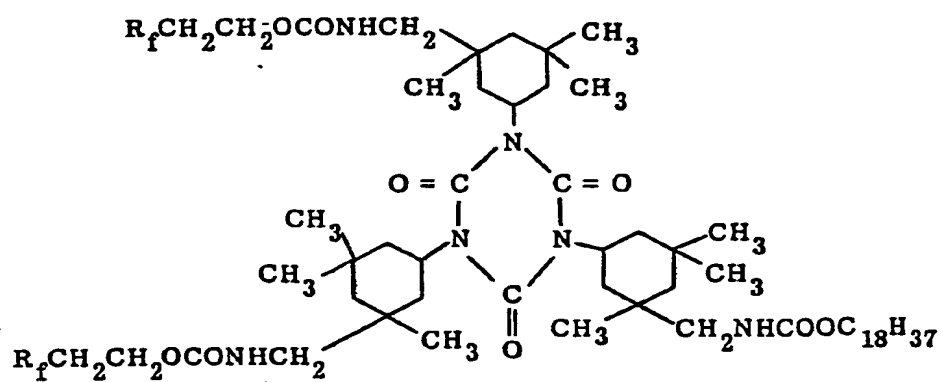
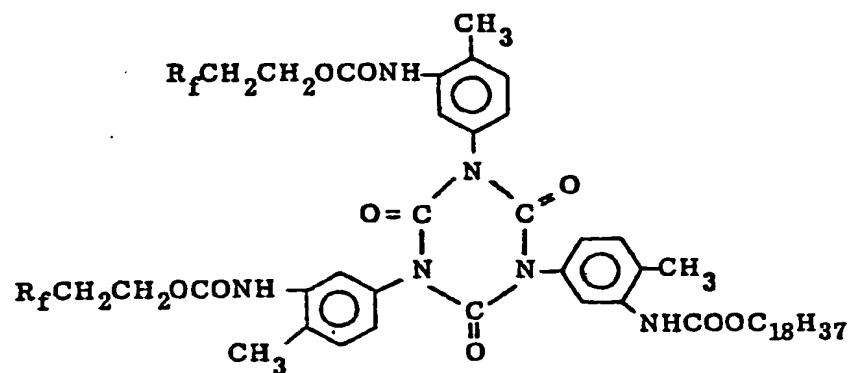
20

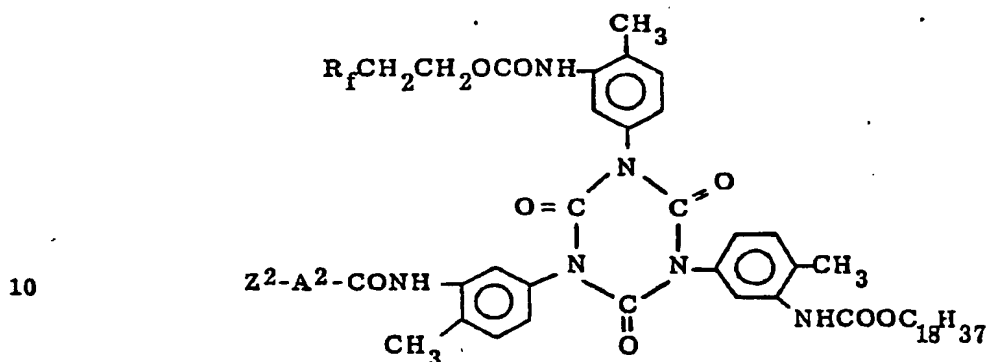
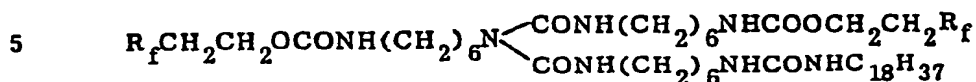




Specific examples of the preferred PFA group-containing compound of the general formula II will be given below.







Now, the process for preparing a stainproofing agent composed of a mixture of PFA group-containing compounds, according to the present invention, will be described.

In the process of the present invention, it is important to use
 15 a mixture (hereinafter referred to simply as an "isocyanate mixture") of polyfunctional isocyanate compounds having at least three -NCO groups. Such a isocyanate mixture is a mixture of compounds containing a -NHCON< bond formed by an addition reaction of a
 >NH group-containing compound with a -NCO group-containing
 20 compound, and is usually advantageously be prepared by reacting and polymerizing a diisocyanate (OCN-Y-NCO) with an active hydrogen atom-containing compound such as water or an amine. Namely, if, for instance, the isocyanate is reacted with water, a dimer of
 OCN-Y-NHCONH-Y-NCO will be formed, and such a dimer will be
 25 reacted as a >NH group-containing compound with a -NCO group

of the diisocyanate or the formed polyisocyanate to form various polyfunctional isocyanate compounds. Y is not particularly critical and various divalent organic groups may be used as Y. For instance, as specific examples of OCN-Y-NCO, there may be mentioned aromatic diisocyanates such as 2,4-tolylenediisocyanate, 4,4'-diphenylmethane-
5 diisocyanate, tolidinediisocyanate and dianisidinediisocyanate; alicyclic diisocyanates such as 2-methyl-cyclohexane-1,4-diisocyanate, isophorone-diisocyanate and hydrogenated MDI ($\text{OCN}-\text{H}-\text{CH}_2-\text{H}-\text{NCO}$);
and aliphatic diisocyanates such as hexamethylene diisocyanates and
10 decamethylene diisocyanates.

There is no particular restriction as to the conditions for the preparation of the isocyanate mixture by the above-mentioned polymerization reaction, and various conditions may be employed. For instance, in the case where water is reacted to OCN-Y-NCO,
15 the reaction may be conducted in a molar ratio of $\text{H}_2\text{O}/\text{OCN-Y-NCO}=3/10$ at a temperature of from 100 to 150°C in the absence of a catalyst when Y is an aromatic group or in the presence of a tertiary amine or a tin catalyst when Y is an aliphatic group.

The isocyanate mixture to be used in the present invention is
20 not restricted to the above-mentioned mixture. For instance, it may be prepared by the synthesis in which various triisocyanate compounds are used. The isocyanate mixture is only required to be a mixture of polyfunctional isocyanate compounds having at least three -NCO groups, and usually contains from 10 to 90% by weight, preferably
25 from 30 to 60% by weight of trifunctional isocyanate compounds (i.e. containing three -NCO groups). The isocyanate mixture preferably contains from 10 to 90% by weight, more preferably from 40 to 70%

by weight of at least tetrafunctional isocyanate compounds (i.e. containing at least four -NCO groups). Further, the molecular weights of the polyfunctional isocyanate compounds in the isocyanate mixture are selected so that the molecular weights of the PFA group-containing compounds thereby obtainable become to be at most 8000. 5 The isocyanate mixture may, of course, contain a diisocyanate so long as the latter does not hinder the effect of the present invention. Thus, the polyfunctional isocyanate compounds in the isocyanate mixture may usually contain from 3 to 15 -NCO groups, preferably 10 from 3 to 8 -NCO groups.

In the present invention, a mixture of PFA group-containing compounds having a molecular weight of at most 8000 and containing at least one -NHCO-A-X-R_f group is obtained by reacting a fluorine-containing compound of R_f-X-A-H to the above-mentioned isocyanate 15 mixture. As such R_f-X-A-H, a R_f-R-OH type fluorine-containing alcohol is preferably employed. Further, a R_f-R-SH type fluorine-containing thioalcohol where A is -S-, may also be employed. It is also possible that by using as a starting material a mixture of a plurality of fluorine-containing alcohols having different number of 20 carbon atoms in R_f or different R, the desired PFA group-containing compounds are prepared in the form of a mixture.

Thus, in the present invention, a fluorine-containing compound of R_f-X-A-H is reacted to the -NCO groups of the polyfunctional isocyanate compounds in the isocyanate mixture. However, it is 25 not necessarily required to convert all of the -NCO groups of the polyfunctional isocyanate compounds to -NHCOAXR_f groups. If required, in addition to the fluorine-containing compound of R_f-X-A-H,

a compound of Z-A'-H may be used to convert the -NCO groups to -NHCOA'Z groups. For instance, with a view to further improving the durability by providing adequate bonding to the surface of the synthetic fibers, it is possible to obtain a final compound having

5 at least one -NHCOA'Z group. In such a case, it is particularly preferred that Z-A'-H is an alcohol wherein A' is -O- or an amine wherein A' is -N(Z')-. With a view to imparting an affinity with the synthetic fiber surface, Z-A'-H may be a combination of an alkanol amine, a diamine or ammonia with a methylol-forming agent as well as

10 an alcohol such as $\text{CH}_2\text{-CHCH}_2\text{-OH}$. Further, it is also possible to obtain a stainproofing agent having especially superior water repellency by using a straight chain stearyl group-containing compound such as $\text{n-C}_{18}\text{H}_{37}\text{OH}$, $\text{n-C}_{18}\text{H}_{37}\text{NH}_2$ or $\text{n-C}_{18}\text{H}_{37}\text{SH}$, as Z-A'-H. In the process of the present invention, it is, of course, possible to use as Z-A'-H

15 a plurality of compounds wherein Z and A' are different.

By the above-mentioned reaction, it is possible to obtain a mixture of PFA group-containing compounds having at least one -NHCOAXR_f group, a molecular weight of at most 8000 and, if required, a -NHCOA'Z group, provided that the total of the -NHCOAXR_f groups

20 and the -NHCOA'Z groups is at least three. Such PFA group-containing compounds should preferably have a molecular weight of from 1500 to 5000, more preferably from 2000 to 4000. If the molecular weight is too great, the durability of the stainproofing effect tends to be poor, and there will be difficulties in the application for use

25 prior to the dyeing step or during the spinning of the base yarns. The derivatives of the present invention obtained from the mixture of polyfunctional isocyanate compounds are superior in the above-mentioned

- 17 -

durability to derivatives obtained from difunctional isocyanate compounds such as the fluorine-containing urethane compounds having a relatively low molecular weight.

In the present invention, the mixture of PFA group-containing compounds (hereinafter referred to simply as a "PFA mixture") comprises compounds containing at least one PFA group in the form of a -NHCOAXR_f group. The respective PFA group-containing compounds constituting the PFA mixture, may be those wherein all of the -NCO groups in the polyfunctional isocyanate compounds in the isocyanate mixture as the starting material are converted to -NHCOAXR_f groups. Usually, however, the compounds may be those wherein at least one of the at least three -NCO groups is converted to a -NHCOAXR_f group. In the latter case, the rest of the -NCO groups are converted to -NHCOA'Z groups. It is usually preferred that the PFA group-containing compounds contain at least one -NHCOAXR_f group and at least one -NHCOA'Z group. In a preferred embodiment, the polyfunctional isocyanate compounds in the isocyanate mixture as the starting material contain from 3 to 15, preferably from 3 to 8, -NCO groups, and accordingly the respective PFA group-containing compounds in the PFA mixture contain from 1 to 14, preferably from 1 to 10, -NHCOAXR_f groups and from 1 to 14, preferably from 1 to 10, -NHCOA'Z groups. The PFA group-containing compounds in the PFA mixture may, of course, be different from one another in the number and type of the -NHCOAXR_f groups or the number and the type of the -NHCOA'Z groups.

The process of the present invention is conducted by reacting $R_f-X-A-H$ and $Z-A'-H$ to the isocyanate mixture in the respective molar amounts corresponding to the molar amount of $-NCO$ groups. From the viewpoints of the yield of the desired product and the
5 reaction rate, it is preferred to employ a method wherein firstly a predetermined amount of $R_f-X-A-H$ is reacted to the isocyanate mixture and then an excess amount of $Z-A'-H$ is reacted thereto. However, it is, of course, possible to reverse the order of the reactions or to react them simultaneously.

10 The reaction of the isocyanate mixture with $R_f-X-A-H$ may be conducted under various reaction conditions in various manners with use of various reaction apparatus. For instance, in a case where $R_f-X-A-H$ is a fluorine-containing alcohol, the reaction is usually conducted at a temperature of from 0 to 200°C, preferably from 40
15 to 100°C. The reaction is preferably conducted in an inert organic solvent. However, in certain cases, the reaction can be conducted without using an inert organic solvent. As the inert organic solvent suitable for use in the reaction, a solvent capable of dissolving the isocyanate mixture is preferred, and as such a solvent, there may
20 be mentioned a halogenated hydrocarbon such as 1,1,1-trichloroethane, trichloroethylene, trichloromethane or trichlorofluoroethane; a hydrocarbon such as benzene, toluene or hexane; an ether such as dioxane, tetrahydrofuran, diethyl ether, dimethoxy ethane or diethylene glycol dimethyl ether; a ketone such as acetone, methylethyl ketone or methyl
25 isobutylketone; an ester such as ethylacetate or butylacetate; dimethylformamide; dimethylsulfoxide; or acetonitrile. By using such an inert organic solvent, a uniform reaction can efficiently and advantageously be carried out. The inert organic solvent is usually used in an amount

of from 1 to 50 moles, preferably from 5 to 20 moles, per mole of the isocyanate mixture. In this reaction, the molar ratio of the fluorine-containing alcohol to the isocyanate mixture is properly selected depending upon the desired number of -NHCOAXR_f groups in the intended PFA group-containing compounds. For instance, if it is intended to obtain the final compounds containing one -NHCOAXR_f group, the fluorine-containing alcohol is used in an amount of about 1 mole per mole of the isocyanate mixture, and usually in an amount of from 0.5 to 2 moles, preferably from 0.8 to 1.3 moles.

10 Likewise, for the reaction with Z-A'-H , various reaction conditions, reaction operation and reaction apparatus may be employed. From the viewpoint of the operation, however, it is preferred to employ a method wherein an excess amount of Z-A'-H is added relative to the remaining -NCO groups in the reaction mixture of the above-mentioned reaction,

15 and the reaction is continuously carried out in the same condition as above. It is, of course, desirable to select the optimum condition depending upon e.g. the type of the starting materials, for instance, by changing the reaction temperature.

The above-mentioned reactions for conversion to -NHCOAXR_f groups and -NHCOA'Z groups are preferably conducted under substantially anhydrous condition to effectively prevent the side reaction. Namely, the presence of water is disadvantageous to the -NCO group. For instance, adequate control of water should be conducted with respect to the starting materials and the reaction apparatus, and the

25 reaction is preferably conducted in an inert gas stream such as dried nitrogen. Further, such a reaction can be efficiently and advantageously conducted in the presence of a salt of an alkyl tin such as dibutyl tin dilaurate or in the presence of a catalyst composed of

a compound having a pK_a of at least 5.0, preferably from 7 to 10. As such a catalyst, there may be used various kinds of catalysts. For instance, there may suitably be used tertiary amines such as trimethylamine, triethylamine, tripropylamine, tributylamine, triallyl-
5 amine, N-methylpiperidine, N-methylpyrrolidine, N-methylmorpholine, N-ethylmorpholine, N,N-dimethylbenzylamine, pyridine, 4-methylpyridine, dimethyl laurylamine, dimethylmyristylamine, dimethylstearylamine, tricaprylamine, methyl distearylamine, methyl dilaurylamine, dimethylcaprylamine, dimethylpalmitylamine, tetramethyl-
10 propylenediamine and pentamethyldiethylenetriamine. In addition to these tertiary amines, there may be used as the catalyst, an alkali-metal alcoholate and an inorganic alkali metal salt, an inorganic alkaline earth metal salt, an ammonium salt, an inorganic salt of metal such as tin, cobalt, iron, titanium, zinc, antimony or lead or an organic
15 salt having a pK_a of at least 0.5. The amount of the catalyst is usually selected within a range of from 0.001 to 10 parts by weight, preferably from 0.1 to 3 parts by weight, per 100 parts by weight of the isocyanate mixture as the starting material.

In the present invention, the PFA group-containing compounds
20 or the mixture of the PFA group-containing compounds may be used in the form of an organic solution or an organic dispersion. However, for the application to the dyeing step, they are preferably used in the form of an aqueous dispersion. In this case, as the dispersing agent, various surfactants such as nonionic, anionic,
25 cationic or amphoteric surfactants may be used. These surfactants may be used in a proper combination. To facilitate the dispersion of the PFA group-containing compounds, an organic solvent may be

incorporated. Further, when a PFA group-containing compounds or a mixture of PFA group-containing compounds is to be dispersed in a medium mainly composed of water, it may be dispersed in the presence of a fluorine-type surfactant such as a hydrophilic group-containing urethane compound represented by the general formula of $R_f-X-A-CONH-Y-NHCO-T$ where R_f , X and A are as defined above, Y is a divalent organic group and T is a hydrophilic group.

As T, there may be used various groups, for instance, a nonionic group represented by the formula of $-(CH_2CH_2O)_l-R^3$ where l is an integer of 1 to 50, and R^3 is a hydrogen atom or a lower alkyl group having from 1 to 4 carbon atoms; an anionic group such as $-(CH_2CH_2O)_l-SO_3M$ where M is a hydrogen atom, an alkali metal or an ammonium group, $-(CH_2CH_2O)_l-PO_3M$, $-CH_2CH_2SO_3M$ or $-CH_2CH_2COOM$; or a cationic group such as $-CH_2CH_2N^{\oplus}R^4R^5R^6X^{\ominus}$ where each of R^4 , R^5 and R^6 is an alkyl group or an aryl group. X is chlorine, bromine, iodine or $OCOCH_3$. From the viewpoint of usefulness in combination with other treating agents, however, the nonionic group such as $-(CH_2CH_2O)_{22}-CH_3$ is preferably used.

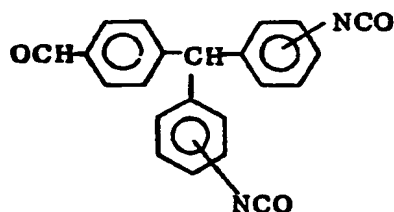
When such a hydrophilic group-containing urethane compound is incorporated, the weight ratio of the PFA group-containing compound/ the hydrophilic group-containing urethane compound is selected within a range of from 99/1 to 25/75, preferably from 95/5 to 50/50.

As the organic solvent to be incorporated at the time of dispersing the PFA group-containing compound or the PFA mixture into water, there may be mentioned a water-soluble ether such as dioxane, tetrahydrofuran or ethylpropylether; a water-soluble glycol ether such as diethylene glycol dimethylether, diethylene glycol

diethylether, ethylene glycol monomethylether, ethylene glycol monoethylether, ethylene glycol monopropylether, ethylene glycol monobutylether, ethylene glycol monophenylether, diethylene glycol monomethylether, diethylene glycol monoethylether, diethylene glycol monopropylether, diethylene glycol monobutylether, triethylene glycol monomethylether, triethylene glycol monoethylether, triethylene glycol monopropylether or triethylene glycol monobutylether; an amide such as formamide, dimethyl formamide or acetoamide; a ketone such as acetone, methylethyl ketone, methylisopropyl ketone, methyliso-
 10 butyl ketone or diacetone alcohol; an alcohol such as methanol, ethanol, propanol or butanol; and an ester such as methylacetate, ethylacetate, propylacetate or butylacetate. The amount of such an organic solvent is usually selected within a range of from 10 to 300 parts by weight, preferably from 20 to 150 parts by weight, per 100 parts by weight
 15 of the PFA group-containing compound or the PFA mixture.

As is apparent from the afore-mentioned specific examples, there is no particular restriction to W so long as it is a trivalent organic group. Namely, for example, W may be illustrated by the following trifunctional isocyanate compounds of W (NCO)₃:

20





15

20

In the present invention, when the PFA group-containing compound or the PFA mixture is to be dispersed in a medium composed mainly of water to obtain an aqueous dispersion, various methods may be employed for the preparation of the dispersion.

5 For instance, there may be mentioned a method in which a mixture of the PFA group-containing compound or the PFA mixture, an emulsifier (i.e. a surfactant) and an aqueous medium, is stirred at a high speed under heating, and then cooled to room temperature, a method wherein an organic solvent solution of the PFA group-
10 containing compound or the PFA mixture (in some cases, an emulsifier is added) is dropwise added into an aqueous solution of an emulsifier under stirring, a method wherein an aqueous solution of an emulsifier is dropwise added to an organic solvent solution of the PFA group-containing compound or the PFA mixture under stirring, a method
15 wherein an organic solvent solution of the PFA group-containing compound or the PFA mixture and an emulsifier is dropwise added into water under stirring, or a method wherein water is dropwise added to such an organic solvent solution under stirring.

When the stainproofing agent of the present invention is
20 prepared in the form of an aqueous dispersion, the solid concentration is not so critical, but is usually adjusted to be from 5 to 60% by weight, preferably from 15 to 50% by weight. In the actual processing, this dispersion is further diluted with water to have a solid concentration of from 0.1 to 4% by weight. Such an aqueous dispersion type
25 stainproofing agent is advantageous over the organic solvent type in that it has a higher ignition point and it is possible to increase the solid concentration and further in that the environmental pollution

- 25 -

for the processing operation can thereby be minimized.

The stainproofing agent of the present invention can be advantageously applied to various articles made of polyamide, polyester, leather or wood, for instance, not only to interior products such as carpets, living room sets, curtains, wall papers or interior articles of vehicles, but also to exterior products such as outdoor tents. It is particularly useful as a stainproofing agent for synthetic fibers, and has a feature that it is applicable prior to the dyeing step or during the spinning of the base yarns.

As the method for the application of the stainproofing agent of the present invention, there is no particular restriction, and various conventional or well known methods may be employed. For instance, it may be applied in such a manner that it is deposited or impregnated on the surface of the article to be treated by means of a conventional application method such as immersion, spraying or coating and then dried. Further, in the application, various other treating agents or additives such as an antistatic agent, a moth-proofing agent, a flame retardant, a dyestuff stabilizer or a wrinkle-preventive agent, may be used in combination.

The stainproofing agent of the present invention has the following advantages. Namely, it has superior water repellency, and when used as a treating agent for spinning, it is capable of imparting an excellent property to the fibers, whereby it has a good stainproofing property and high abrasion durability. Further, it has good compatibility with a spinning solution. Especially when it is prepared in the form of an aqueous dispersion, it has high stability, whereby the treating agent does not fall off during the

dyeing operation, thus providing satisfactory dyeing.

Now, the present invention will be described in further detail with reference to Examples.

However, it should be understood that the present invention .
5 is by no means restricted by these specific examples. Unless otherwise specified, "%" or "parts" mean "% by weight" and "parts by weight".

In the following Examples and Comparative Examples, the water repellency and the oil repellency were measured in the following manners.
10 Namely, in Examples 1 to 9 and 17 to 20 and Comparative Examples 1 and 2. The water repellency was evaluated by placing a few drops of a mixed solution comprising 20 parts by volume of isopropanol and 80 parts by volume of water on a sample cloth at two locations, and the water repellency was represented by the time required for
15 the solution to soak into the cloth. In the rest of the Examples and Comparative Examples, water repellency was evaluated by placing a few drops of the aqueous isopropanol solution having a composition as shown in the following Table 1, on a test cloth, and the water repellency was represented by the point representing the maximum
20 concentration at which the aqueous solution was maintained without soaking into the cloth. The oil repellency was determined by placing a few drops (a diameter of about 4 mm) of the test solution as shown in the following Table 2, on a sample cloth at two locations, and evaluating the infiltration condition upon expiration of 30 seconds
25 (AATCC-TM 118-1966).

Table 1

Water repellency	Isopropanol concentration (% by volume) in an aqueous isopropanol solution
5	40
4	30
3	20
2	10
1	0
0	Incapable of maintaining water drops

Table 2

(AATCC-TM 118-1966)

Oil repellency	Test solution	Surface tension dyne/cm 25°C
8	n-Heptane	20.0
7	n-Octane	21.8
6	n-Decane	23.5
5	n-Dodecane	25.0
4	n-Tetradecane	26.7
3	n-Hexadecane	27.3
2	Hexadecane 35/Nujol 65 mixed solution	29.6
1	Nujol	31.2
0	Poorer than 1	

For the determination of the stainproofing property, a sample cloth was cut into a sample of 5 x 7 cm, and the sample and a dry dust as shown in the following Table 3 (in an amount twice the weight of the sample) were put in a container and vigorously mixed for 3 minutes for staining. After the staining operation, an excess dust was removed by an electric cleaner, and the reflectance was measured to evaluate the staining rate. The staining rate was calculated in accordance with the following equation.

$$\text{Staining rate (\%)} = \frac{R_o - R}{R_o} \times 100$$

R_o : Reflectance of non-stained cloth

R : Reflectance of stained cloth

Table 3

Dust	% by weight
Peat moss	38
Cement	17
Kaolin clay	17
Silica	17
Carbon black	1.75
Ferric oxide	0.50
Mineral oil	8.75

Synthesis 1

Into a four necked flask having an internal capacity of 500 ml and equipped with a stirrer, a dropping funnel, a thermometer and a condenser, 95.6 g (0.2 mole) of $\text{OCN}-(\text{CH}_2)_6-\text{N} \begin{matrix} \swarrow \\ \searrow \end{matrix} \begin{matrix} \text{CONH}(\text{CH}_2)_6-\text{NCO} \\ \text{CONH}(\text{CH}_2)_6-\text{NCO} \end{matrix}$

- 5 0.3 g of $(\text{C}_4\text{H}_{10})_2\text{Sn}(\text{OCOC}_{11}\text{H}_{23})_2$ and 100 g of dioxane were fed. While maintaining the temperature at 80°C , 205.6 g (0.4 mole) of $\text{C}_n\text{F}_{2n+1}\text{CH}_2\text{CH}_2\text{OH}$ (where n is a mixture of 6, 8, 10 and 12, and has a average value of 9.0) was dropwise added in 2 hours by means
- 10 of the dropping funnel. Then, the reaction temperature was lowered to 60°C , and 14.8 g (0.2 mole) of $\text{CH}_2-\underset{\text{O}}{\text{CH}}\text{CH}_2\text{OH}$ was added.
- The reaction was conducted for 1 hour. The reaction rate was 100%.

Synthesis 2

	R_f compound of Synthesis 1	10 parts
15	Butyl acetate	15 parts
	PBC-44 (Nonionic emulsifier manufactured by Nikko Chemical Co.)	2 parts
	Tween 80 (Nonionic emulsifier manufactured by Kao Atlas Co.)	2 parts
	Famin DMC (Cationic emulsifier manufactured by Kao Soap Co., Ltd.)	1 part
20	Water (Deionized water)	70 parts

The above mixture was stirred at 80°C for 30 minutes at 1000 rpm and pre-emulsified, and then emulsified at 60°C for 30 minutes by means of a homogenizer, whereupon a treating agent composed of an aqueous latex was obtained.

EXAMPLE 1:

The aqueous latex of Synthesis 2 was diluted with deionized water to bring the solid content to 0.5% by weight. A nylon knitted cloth was immersed in the emulsion for 2 seconds, and then the cloth was squeezed between two rubber rollers to bring the wet pick-up to 90%. Then, the cloth was dried at 100°C for 3 minutes. With respect to the treated cloth thus obtained, the initial water repellency and oil repellency and the stainproofing property were measured. The results are shown in Table 4.

Then, the following dyeing solution was fed in a pot of a Color Pet (manufactured by Nippon Senshoku Kikai K.K.), and the above treated cloth was put in a holder. After raising the temperature to 100°C, it was dyed for 60 minutes.

Dyestuff (Suminol Leveling Sky Blue R: acid dye manufactured by Sumitomo Chemical Co., Ltd.)	1% owf
$(\text{NH}_4)_2\text{SO}_4$	3% owf
Dyeing assistant (Disper SV: anionic dispersing agent manufactured by Meisei Chemical Industry Co.)	1% owf
Bath ratio (1 : 20)	

The dyed cloth was washed with water for 10 minutes, and then dried at 85°C for 10 minutes. The water repellency and oil repellency and the stainproofing property of the dyed cloth thereby obtained were measured. The results are shown in Table 4.

EXAMPLES 2 to 9:

Each of the R_f compounds shown in Table 4 prepared in the same manner as in Synthesis 1 was made into an aqueous dispersion in the same manner as in Synthesis 2. A nylon knit cloth was treated in the same manner as in Example 1, whereupon the water repellency and the stainproofing property of the treated cloth were measured. The results are shown in Table 4.

COMPARATIVE EXAMPLES 1 and 2:

With respect to the R_f compounds derived from difunctional isocyanate compounds as shown in Table 4, the properties were measured in the same manner as in Examples 1 to 9. The results are shown in Table 4.

Table 4

	R _f Compounds	Initial			After dyeing		
		Water repellency	Oil repellency	Stain-proofing property	Water repellency	Oil repellency	Stain-proofing property
Example 1	$R_fCH_2CH_2OCONH(CH_2)_6N<\begin{matrix} CONH(CH_2)_6NHCOOCH_2CH_2R_f \\ CONH(CH_2)_6NHCOOCH_2CH_2CH_2CH_2O \end{matrix}$	More than 3 min.	6	8	More than 3 min.	6	8
Example 2	$R_fCH_2CH_2OCONH(CH_2)_6N<\begin{matrix} CONH(CH_2)_6NHCOOCH_2CH_2R_f \\ CONH(CH_2)_6NHCONHCH_2CH_2OH \end{matrix}$	More than 3 min.	6	8	More than 3 min.	5	8
Example 3	$R_fCH_2CH_2OCONH(CH_2)_6N<\begin{matrix} CONH(CH_2)_6NHCOOCH_2CH_2CH_2O \\ CONH(CH_2)_6NHCOOCH_2CH_2CH_2O \end{matrix}$	More than 3 min.	6	7	More than 3 min.	6	7
Example 4	$R_fCH_2CH_2OCONH(CH_2)_6N<\begin{matrix} CONH(CH_2)_6NHCOOCH_2CH_2R_f \\ CONH(CH_2)_6NHCOOCH_3 \end{matrix}$	More than 3 min.	6	7	More than 3 min.	5	7
Example 5	$R_fCH_2CH_2OCONH(CH_2)_6N<\begin{matrix} CONH(CH_2)_6NHCOOCH_2CH_2R_f \\ CONH(CH_2)_6NHCON<\begin{matrix} CH_3 \\ CH_3 \end{matrix} \end{matrix}$	More than 3 min.	6	6	More than 3 min.	5	6
Example 6	$R_fCH_2CH_2OCONH(CH_2)_6N<\begin{matrix} CONH(CH_2)_6NHCOOCH_2CH_2R_f \\ CONH(CH_2)_6NHCOOCH_2CH_2CN \end{matrix}$	More than 3 min.	6	8	More than 3 min.	6	8
Example 7	$R_fCH_2CH_2OCONH(CH_2)_6N<\begin{matrix} CONH(CH_2)_6NHCOOCH_2CH_2R_f \\ CONH(CH_2)_6NHCON<\begin{matrix} CH_2 \\ CH_2 \end{matrix} \end{matrix}$	More than 3 min.	6	7	More than 3 min.	6	7

Table 1 (cont.)

Table 3 (cont'd)

	R _f Compounds	Initial			After dyeing		
		Water repellency	Oil repellency	Stain-proofing property	Water repellency	Oil repellency	Stain-proofing property
Example 8	<p>Chemical structure of Example 8: A central benzene ring with a $-\text{CH}_2\text{CH}_2\text{OCONHCH}_2-$ group at position 1 and a $-\text{CH}_2\text{CH}_2\text{OCONHCH}_2-$ group at position 4. The benzene ring is also substituted with two $-\text{CH}(\text{CH}_3)_2$ groups at positions 2 and 3. The two $-\text{CH}_2\text{CH}_2\text{OCONHCH}_2-$ groups are linked to a central $-\text{C}(=\text{O})-$ group, which is further linked to a central $-\text{N}(\text{CH}_2\text{CH}_2\text{OCONHCH}_2)-$ group. The central $-\text{N}(\text{CH}_2\text{CH}_2\text{OCONHCH}_2)-$ group is also linked to a central $-\text{C}(=\text{O})-$ group, which is further linked to a central $-\text{N}(\text{CH}_2\text{CH}_2\text{OCONHCH}_2)-$ group.</p>	More than 3 min.	6	8	More than 3 min.	6	8
Example 9	<p>Chemical structure of Example 9: A central benzene ring with a $-\text{CH}_2\text{CH}_2\text{OCONHCH}_2-$ group at position 1 and a $-\text{CH}_2\text{CH}_2\text{OCONHCH}_2-$ group at position 4. The benzene ring is also substituted with two $-\text{CH}(\text{CH}_3)_2$ groups at positions 2 and 3. The two $-\text{CH}_2\text{CH}_2\text{OCONHCH}_2-$ groups are linked to a central $-\text{C}(=\text{O})-$ group, which is further linked to a central $-\text{N}(\text{CH}_2\text{CH}_2\text{OCONHCH}_2)-$ group. The central $-\text{N}(\text{CH}_2\text{CH}_2\text{OCONHCH}_2)-$ group is also linked to a central $-\text{C}(=\text{O})-$ group, which is further linked to a central $-\text{N}(\text{CH}_2\text{CH}_2\text{OCONHCH}_2)-$ group.</p>	More than 3 min.	6	7	More than 3 min.	6	7
Comparative Example 1	<p>Chemical structure of Comparative Example 1: A central benzene ring with a $-\text{CH}_2\text{CH}_2\text{OCONHCH}_2-$ group at position 1 and a $-\text{CH}_2\text{CH}_2\text{OCONHCH}_2-$ group at position 4. The benzene ring is also substituted with two $-\text{CH}(\text{CH}_3)_2$ groups at positions 2 and 3. The two $-\text{CH}_2\text{CH}_2\text{OCONHCH}_2-$ groups are linked to a central $-\text{C}(=\text{O})-$ group, which is further linked to a central $-\text{N}(\text{CH}_2\text{CH}_2\text{OCONHCH}_2)-$ group. The central $-\text{N}(\text{CH}_2\text{CH}_2\text{OCONHCH}_2)-$ group is also linked to a central $-\text{C}(=\text{O})-$ group, which is further linked to a central $-\text{N}(\text{CH}_2\text{CH}_2\text{OCONHCH}_2)-$ group.</p>	More than 3 min.	6	8	3 min.	2	15
Comparative Example 2	<p>Chemical structure of Comparative Example 2: A central benzene ring with a $-\text{CH}_2\text{CH}_2\text{OCONHCH}_2-$ group at position 1 and a $-\text{CH}_2\text{CH}_2\text{OCONHCH}_2-$ group at position 4. The benzene ring is also substituted with two $-\text{CH}(\text{CH}_3)_2$ groups at positions 2 and 3. The two $-\text{CH}_2\text{CH}_2\text{OCONHCH}_2-$ groups are linked to a central $-\text{C}(=\text{O})-$ group, which is further linked to a central $-\text{N}(\text{CH}_2\text{CH}_2\text{OCONHCH}_2)-$ group. The central $-\text{N}(\text{CH}_2\text{CH}_2\text{OCONHCH}_2)-$ group is also linked to a central $-\text{C}(=\text{O})-$ group, which is further linked to a central $-\text{N}(\text{CH}_2\text{CH}_2\text{OCONHCH}_2)-$ group.</p>	More than 3 min.	6	8	2 min.	2	14

- 34 -

In the above Table 4, R_f is C_nF_{2n+1} (where n is a mixture of 6, 8, 10 and 12, and has an average value of 9.0).

Synthesis 3

Into a four necked flask having an internal capacity of 500 ml and equipped with a stirrer, a dropping funnel, a thermometer and a condenser, 95.6 g (0.2 mole) of $OCN-(CH_2)_6 N \begin{matrix} \swarrow \\ \searrow \end{matrix} \begin{matrix} CONH(CH_2)_6-NCO \\ CONH(CH_2)_6-NCO \end{matrix}$, 0.3 g of $(C_4H_{10})_2Sn(OCOC_{11}H_{23})_2$ and 100 g of dioxane were fed. While maintaining the temperature at 80°C, 205.6 g (0.4 mole) of $C_nF_{2n+1}CH_2CH_2OH$ (where n is a mixture of 6, 8, 10 and 12, and has an average value of 9.0) was dropwise added in 2 hours by means of the dropping funnel. Then, the reaction temperature was lowered to 60°C, and 54.0 g (0.2 mole) of $n-C_{18}H_{37}OH$ was added. The reaction was conducted for 1 hour. The reaction rate was 100%.

The analysis of the product was conducted by gel permeation chromatography and nuclear magnetic resonance spectrum.

Synthesis 4

	R_f compound of Synthesis 3	10 parts
	Butyl acetate	15 parts
20	PBC-44 (Nonionic emulsifier manufactured by Nikko Chemical Co.)	2 parts
	Tween 80 (Nonionic emulsifier manufactured by Kao Atlas Co.)	2 parts
	Famin DMC (Cationic emulsifier manufactured by Kao Soap Co., Ltd.)	1 part
25	Water (Deionized water)	70 parts

The above mixture was stirred at 80°C for 30 minutes at 1000 rpm and pre-emulsified, and then emulsified at 60°C for 30 minutes by means of a homogenizer, whereby a treating agent composed of an aqueous latex was obtained.

EXAMPLE 10:

The aqueous latex of Synthesis 4 was diluted with deionized water to bring the solid content to 0.5% by weight. A nylon knitted cloth was immersed in the emulsion for 2 seconds, and the cloth was squeezed between two rubber rollers to bring the wet pick-up to 90%. Then, the cloth was dried at 100°C for 3 minutes. With respect to the treated cloth thus obtained, the initial water repellency and oil repellency and the stainproofing property were measured. The results are shown in Table 5.

Then, the following dyeing solution was fed in a pot of Color Pet (manufactured by Nippon Senshoku Kikai K.K.), and the above treated cloth was put in a holder. After raising the temperature to 100°C, the cloth was dyed for 60 minutes.

Dyestuff (Suminol Leveling Sky Blue R:
acid dye manufactured by Sumitomo
Chemical Co., Ltd.) 1% owf

$(\text{NH}_4)_2\text{SO}_4$ 3% owf

Dyeing assistant (Disper SV: anionic dispersing agent manufactured by Meisei Chemical Co.) 1% owf

Bath ratio (1 : 20)

The dyed cloth was washed with water for 10 minutes, and then dried at 85°C for 10 minutes. The water repellency and oil repellency and the stainproofing property of the dyed cloth thus obtained were measured. The results are shown in Table 5.

EXAMPLES 11 to 16:

Each of the R_f compounds as shown in Table 5 prepared in the same manner as in Synthesis 3, was made into an aqueous dispersion in the same manner as in Synthesis 4. A nylon knitted cloth was
5 treated in the same manner as in Example 10, whereupon the water repellency and oil repellency and the stainproofing property of the cloth were measured. The results are shown in Table 5.

COMPARATIVE EXAMPLES 3 and 4:

With respect to the R_f compounds derived from the difunctional
10 isocyanate compounds as shown in Table 5, the properties were measured in the same manner as in Examples 10 to 16. The results are shown in Table 5.

Table 5

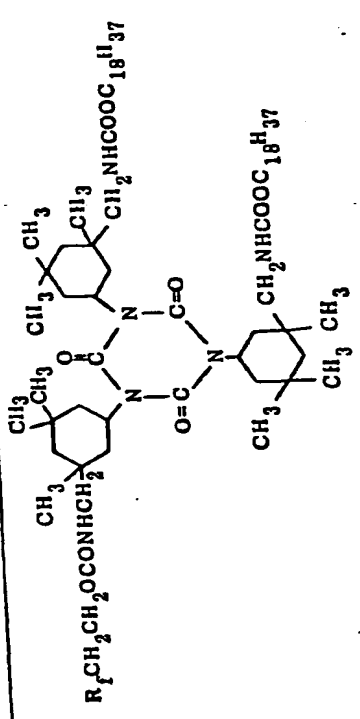
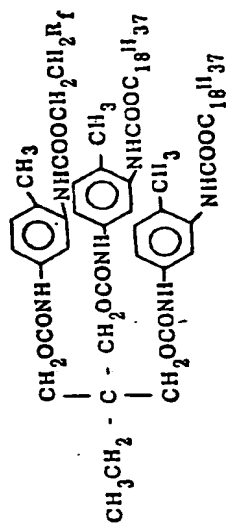
	R _f Compound	Initial			After dyeing		
		Water repellency	Oil repellency	Stain-proofing property	Water repellency	Oil repellency	Stain-proofing property
Example 10	$R_f CH_2 CH_2 OCONH(CH_2)_6 N \begin{matrix} \diagup \\ \diagdown \end{matrix} \begin{matrix} CONH(CH_2)_6 NHCOOCH_2 CH_2 R_f \\ CONH(CH_2)_6 NHCOOC_{18}H_{37} \end{matrix}$	5	6	8	5	6	8
Example 11	$R_f CH_2 CH_2 OCONH(CH_2)_6 N \begin{matrix} \diagup \\ \diagdown \end{matrix} \begin{matrix} CONH(CH_2)_6 NHCOOC_{18}H_{37} \\ CONH(CH_2)_6 NHCOOC_{18}H_{37} \end{matrix}$	5	5	9	5	5	9
Example 12		5	5	9	5	5	10
Example 13		4	5	9	5	5	10

Table 5 (cont'd)

	R _f Compound	Initial			After dyeing		
		Water repellency	Oil repellency	Stain-proofing property	Water repellency	Oil repellency	Stain-proofing property
Example 14	$R_fCH_2CH_2OCONH(CH_2)_6N\begin{matrix} \diagup \\ \text{CONH}(CH_2)_6NIICOCOC_{18}H_{37} \\ \diagdown \\ \text{CONH}(CH_2)_6NIICOCOC_{18}H_{37} \end{matrix}$	5	6	7	5	6	6
Example 15	$R_fCH_2CH_2OCONH(CH_2)_6N\begin{matrix} \diagup \\ \text{CONH}(CH_2)_6NIICOCOC_{18}H_{37} \\ \diagdown \\ \text{CONH}(CH_2)_6NIICOCOC_{18}H_{37} \end{matrix}$	5	6	8	5	6	8
Example 16	$R_fCH_2CH_2OCONH(CH_2)_6N\begin{matrix} \diagup \\ \text{CONH}(CH_2)_6NHCOCOC_{18}H_{37} \\ \diagdown \\ \text{CONH}(CH_2)_6NHCOCOC_{18}H_{37} \end{matrix}$	5	6	8	5	6	8
Comparative Example 3	$R_fCH_2CH_2OCONH\text{-}\langle\text{C}_6\text{H}_4\rangle\text{-}NHCOOCH_3$	3	5	8	3	2	15
Comparative Example 4	$R_fCH_2CH_2OCONH\text{-}\langle\text{C}_6\text{H}_4\rangle\text{-}NHCON\begin{matrix} \diagup \\ CH_3 \\ \diagdown \\ CH_3 \end{matrix}$	3	6	8	3	2	14

In the above Table 5, R_f is C_nF_{2n+1} (where n is a mixture of 6, 8, 10 and 12, and has an average value of 9.0).

Synthesis 5

Into a four necked flask having an internal capacity of 500 ml and equipped with a stirrer, a dropping funnel, a thermometer and a condenser, 100 g of Desmodur-TPKL (hexamethylenediisocyanate polymer which contains 40% of a trimer and 22.6% of isocyanate, manufactured by Sumitomo-Bayer Co.), 0.3 g of $Bu_2Sn(OCOC_{11}H_{23})_2$ and 100 g of dioxane were fed. While maintaining the temperature at 70°C, 224 g of $C_nF_{2n+1}CH_2CH_2OH$ (where n is a mixture of 6, 8, 10 and 12, and has an average value of 9.0) was dropwise added in 2 hours by means of the dropping funnel. Then, the reaction temperature was lowered to 60°C, and 9.3 g of CH_2-CHCH_2OH was added. The reaction was conducted for 1 hour. The reaction rate was 100%. The reaction rate was confirmed by gas chromatography and infrared spectrophotometry. The product was analyzed by GPC.

Syntheses 6 and 7

The Synthesis were conducted in the same manner as in Synthesis 5. The results are shown in Table 6.

Table 6

Syntheses	Isocyanate polymers	$R_f-X-A-H$	$Z-A'-H$	Reaction rate
6	Desmodur-TPKL 100 g	$C_nF_{2n+1}C_2H_4OH$ 224 g	$C_{18}H_{37}OH$ 41.2 g	100%
7	"	$C_8F_{17}SO_2NC(CH_3)_2H_4OH$ 235.8 g	CH_2-CHCH_2OH 41.2 g	100%

Synthesis 8

Into a four necked flask having an internal capacity of 2 l and equipped with a stirrer, a dropping funnel, a thermometer and a condenser, 348 g of toluene, 2,4-diisocyanate was fed. While
 5 maintaining the temperature at 90°C, 10.8 g of distilled water was dropwise added in 5 hours. The temperature was raised to 140°C and the reaction was conducted for 3 hours. The reaction product contained 26.0% of isocyanate.

The temperature was brought to 70°C, and 350 g of dioxane
 10 was added. Then, 900 g of $C_nF_{2n+1}C_2H_4OH$ (where n is a mixture of 6, 8, 10 and 12, and has an average value of 9.0) was dropwise added in 2 hours by means of the dropping funnel. Then, the reaction temperature was lowered to 60°C, 37.2 g of $\begin{array}{c} CH_2-CHCH_2OH \\ \diagdown \quad \diagup \\ \quad O \end{array}$
 15 was added. The reaction was conducted for 1 hour. The reaction rate was 100%. The reaction rate was confirmed by gas chromatography and infrared spectrophotometry. The product was analyzed by GPC.

EXAMPLES 17 to 20:

	Compound of each of Syntheses 5 to 8	10 parts
20	Butyl acetate	15 parts
	PBC-44 (Nonionic emulsifier manufactured by Nikko Chemical Co.)	2 parts
	Tween 80 (Nonionic emulsifier manufactured by Kao Atlas Co.)	2 parts
	Famin DMS (Cationic emulsifier manufactured by Kao Soap Co., Ltd.)	1 part
25	Water (Deionized water)	70 parts

- 41 -

The above mixture was stirred at 80°C for 30 minutes at 1000 rpm and pre-emulsified, and then emulsified at 60°C for 30 minutes by means of a homogenizer, whereby a treating agent composed of an aqueous latex was obtained. This dispersion was diluted with deionized water to bring the solid content to 0.5% by weight. A nylon knitted cloth was immersed in the emulsion for 2 seconds, and the cloth was squeezed through two rubber rollers to bring the wet pick-up to 90%. Then, the cloth was dried at 100°C for 3 minutes. With respect to the treated cloth thus obtained, the initial water repellency and oil repellency and the stainproofing property was measured. The results are shown in Table 7.

	Dyestuff (Suminol Leveling Sky Blue R: acid dye manufactured by Sumitomo Chemical Co., Ltd.	1% owf
	$(\text{NH}_4)_2\text{SO}_4$	3% owf
15	Dyeing assistant (Disper SV: anionic dispers- ing agent manufactured by Meisei Chemical Co.)	1% owf
	Bath ratio (1: 20)	

The above dyeing solution was fed in a pot of Color Pet (manufactured by Nippon Senshoku Kikai K.K.), and the above nylon knitted cloth was put in a holder. After raising the temperature to 100°C, the cloth was dyed for 60 minutes. The dyed cloth was washed with water for 10 minutes, and then dried at 85°C for 10 minutes. The water repellency and oil repellency and the anti-dry soil property of the nylon cloth thus obtained, were measured. The results are shown in Table 7.

Table 7

Examples	Initial			After dyeing		
	Water repellency	Oil repellency	Stainproofing property	Water repellency	Oil repellency	Stainproofing property
17	More than 3 minutes	6	7	More than 3 minutes	6	8
18	More than 3 minutes	6	8	More than 3 minutes	6	9
19	More than 3 minutes	5	9	More than 3 minutes	5	10
20	More than 3 minutes	5	9	More than 3 minutes	5	10

CLAIMS:

1. A stainproofing agent containing as an active ingredient a polyfluoroalkyl group-containing compound represented by the following general formula and having a molecular weight of from 800 to 3000:

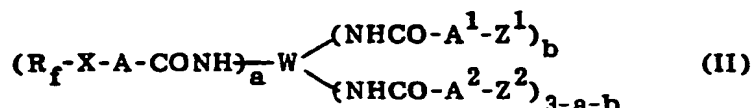


where R_f is a polyfluoroalkyl group having from 1 to 20 carbon atoms, X is $-R-$, $-CON(R^1)-Q-$ or $-SO_2N(R^1)-Q-$ (where R is a divalent alkylene group, R^1 is a hydrogen atom or a lower alkyl group and Q is a divalent organic group), each of A and A' is $-O-$, $-S-$ or $-N(Z')$ (where Z' is a hydrogen atom or a monovalent organic group), Z is a monovalent organic group, W is a trivalent organic group, a is an integer of 1, 2 or 3.

2. The stainproofing agent according to Claim 1, wherein R_f is a perfluoroalkyl group represented by the general formula C_nF_{2n+1} (where n is an integer of 4 to 16), X is an alkylene group represented by the general formula C_mH_{2m} (where m is an integer of 1 to 10), A is $-O-$, A' is $-O-$ or $-N(Z')$ (where Z' is as defined in Claim 1), and a is an integer of 1 or 2.

3. The stainproofing agent according to Claim 2, wherein $-A'-Z$ is $-OCH_2CH-CH_2$, $-OR'$, $-OCH_2CH_2CN$, $-OCH_2CH_2NO_2$, $-OCH_2CH_2OH$, $-NHCH_2OH$, $-NHCH_2CH_2OH$, $-N\begin{smallmatrix} CH_2 \\ | \\ CH_2 \end{smallmatrix}$, $-NHR'$, $-NR'R'$, $-N(CH_2CH_2OH)_2$ or $-NHCH_2CH_2O-CH_2CH-CH_2$ (where R' is an alkyl group).

4. The stainproofing agent according to Claim 1, wherein the polyfluoroalkyl group-containing compound is represented by the general formula:



where R_f , X, A and W are as defined in Claim 1, each of A^1 and A^2 is -O-, -S- or -N(Z')- (where Z' is as defined in Claim 1), Z^1 is a straight chain stearyl group, Z^2 is a monovalent organic group, a is an integer of 1 or 2 and b is an integer of 1 or 2.

5. The stainproofing agent according to Claim 4, wherein R_f is a perfluoroalkyl group represented by the general formula C_nF_{2n+1} (where n is an integer of 4 to 16), X is an alkylene group represented by the general formula C_mH_{2m} (where m is an integer of 1 to 10), A is -O-, A^1 is -O- and A^2 is -O- or -N(Z')- (where Z' is a hydrogen atom or a monovalent organic group).

6. The stainproofing agent according to Claim 4, wherein a is 1, b is 1, and $-A^2-Z^2$ is $-OCH_2CH(CH_2O)CH_2$, -OR', $-OCH_2CH_2CN$, $-OCH_2CH_2NO_2$, $-OCH_2CH_2OH$, $-NHCH_2OH$, $-NHCH_2CH_2OH$, $-N(CH_2CH_2OH)_2$ or $-NHCH_2CH_2OCH_2CH(CH_2O)CH_2$ (where R' is an alkyl group).

7. A process for preparing a stainproofing agent, which comprises reacting a mixture of polyfunctional isocyanate compounds having at least three -NCO groups and a $-NHCON<$ bond derived from an addition reaction of a $>N-H$ group-containing compound with a -NCO group-containing compound, with a compound represented by the general formula $R_f-X-A-H$ where R_f is a polyfluoroalkyl group having from 1 to 20 carbon atoms, X is -R-, $-CON(R^1)-Q-$ or $-SO_2N(R^1)-Q-$ (where R is a divalent alkylene group, R^1 is a hydrogen atom or a lower alkyl group and Q is a divalent organic group) and A is -O-, -S- or -N(Z')- (where Z' is a hydrogen atom or a monovalent organic group), and,

- if required, further reacting the mixture with a compound represented by the general formula $Z-A'-H$ where Z is a monovalent organic group and A' is $-O-$, $-S-$ or $-N(Z)-$ (where Z' is a hydrogen atom or a monovalent organic group), to form a mixture of polyfluoroalkyl group-
- 5 containing compounds having at least one $-NHCO-A-X-R_f$ group where A , X and R_f are as defined above, a molecular weight of at most 8000 and, if required, at least one $-NHCO-A'-Z$ group where A' and Z are as defined above, provided that the total of the $-NHCO-A-X-R_f$ groups and the $-NHCO-A'-Z$ groups is at least three.
- 10 8. The process according to Claim 7, wherein the mixture of polyfunctional isocyanate compounds is a mixture of polymers obtained by reacting diisocyanate compounds with an active hydrogen atom-containing compound.
9. The process according to Claim 7, wherein the mixture of poly-
- 15 functional isocyanates comprises from 10 to 90% by weight of a trifunctional isocyanate compound having three $-NCO$ groups and from 10 to 90% by weight of polyfunctional isocyanate compounds having at least four $-NCO$ groups.

**This Page is Inserted by IFW Indexing and Scanning
Operations and is not part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☐ FADED TEXT OR DRAWING
- ☒ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☐ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☐ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☐ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: _____

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.